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Issue 29

Compass Points

December 2002

BCRA

Adapting a maglite to light your compass

Revised BCRA survey grades

The Journal of the BCRA Cave Surveying Group

COMPASS POINTS INFORMATION

Compass Points is published three times yearly in March, July and November. The Cave Surveying Group is a Special Interest Group of the British Cave Research Association. Information sheets about the CSG are available by post or by e-mail. Please send an SAE or Post Office International Reply Coupon.

NOTES FOR CONTRIBUTORS
Articles can be on paper, but the preferred format is ASCII text files with paragraph breaks. If articles are particularly technical (i.e. contain lots of sums) then Latex, OpenOffice.org or Microsoft Word documents are probably best. We are able to cope with many other formats and can accept disks from other machines, but please check first. We can accept most common graphics formats, but vector graphic formats are much preferred to bit-mapped formats for diagrams. Photographs should be prints, or well-scanned photos supplied in any common bitmap format. It is the responsibility of contributing authors to clear copyright and acknowledgement matters for any material previously published elsewhere and to ensure that nothing in their submissions may be deemed libellous or defamatory.

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OBJECTIVES OF THE GROUP
The group aims, by means of a regular Journal, other publications and meetings, to disseminate information about, and develop new techniques for, cave surveying.

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courtesy of Doug Dotson, Speleotechnologies.

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CAVE SURVEYING MAILING LIST
The CSG now runs an e-mail list for cave surveyors around the world. To join send a message containing the word 'subscribe' in the body text to cave-surveying-request@survex.com

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The journal of the BCRA Cave Surveying Group

Cover photos: All the action from the Autumn CSG field meet. Clockwise from the top left: using the surface radiolocation receiver, reading the clino in OFD, compass calibration and the underground radiolocation beacon. Photos provided by Jos Burgers.

Editorial

Apologies for the extremely late arrival of this issue – car fettling and Christmas revelry are my excuses. Also apologies that, after all that waiting, this issue is a bit thin on material. There are two or three more articles that are very nearly finished but at the same time sufficiently far from completion that I have held them over to issue 30. I am always on the look-out for new material, so if you have any ideas for topics you would like to see covered in Compass Points, or (better still) have an idea for an article you would be prepared to write, please get in touch.

CSG Admin.

CSG Committee

The CSG held its AGM at the Hidden Earth conference in September, as a result of which a new committee was elected. This was almost identical to the previous committee, except that I lost the “acting” bit of my editor's title. However, since that time, Andy Atkinson has resigned from BCRA, which means he is no longer able to serve on the committee. So the CSG committee now comprises:

Chairman: Wookey
Editor/Publicity: Anthony Day.

Andy wishes it to be made clear that he is happy to continue to support the CSG, and would be willing to take on a committee post if he were to rejoin BCRA in the future. However, this doesn't solve the Group's immediate problem of having neither a secretary nor a treasurer.

For the time being, Andy will continue to fulfil these roles in an unofficial capacity. Clearly this is a non-ideal situation, so if there are any BCRA members who would be willing to take on one or both of these jobs, please make yourself known. Also, if anyone has the time to keep the CSG website up to date (officially or unofficially) we'd like to hear from you.

Compass Points Publication Dates

Those of you who read and digest the masthead in its entirety will already be aware that the publication dates for Compass Points have changed. Henceforth there will be three issues per year instead of four as was the case previously. These will be cover dated March, July and November. In each case it is my intention to publish in the middle of the month, and I will therefore need to receive any material for publication by the end of the previous month.

The main reason for this change is to put the publication dates at times of the year that are convenient for me (i.e. when I am least likely to be busy) in the hope that issues will appear more-or-less on time in future (unlike this one...)

Subscription rates are unchanged for the time being, and will still cover four issues. If this is particularly inconvenient for anyone (thinking particularly of anyone who pays their Compass Points subscription annually with their BCRA subscription) please get in touch.

Future of the CSG

The likely forthcoming reorganisation of British caving presents an opportunity for us to consider where the CSG best fits in the new order. For those not in the know, it is proposed that a new national body will be created that will provide a single point of contact for services to cavers that are currently split between the National Caving Association, BCRA and other bodies (with considerable overlap). The BCRA is likely to remain as a “cave science” body. What follows is a summary of some of the options that have been discussed at the AGM and elsewhere.

The CSG could remain as a Special Interest Group within the BCRA. Much of the work that the CSG performs and promotes, via field meets and articles in Compass Points, falls within the broad definition of cave science . On the other hand, it has been suggested that the subject of cave surveying is much wider than the scientific elements. A good survey is integral to successful exploration. Combine this with the question "What do we do with data when we have it?" (e.g. the cave survey data archiving proposals) plus how do you use surveying in exploration etc. and it is clear that the subject is bigger than the science of cave surveying. If the CSG sees its role as to promote good surveying practice and advertise new ideas to the widest possible audience, then, it could be argued, the best place for the Group to achieve this might be as a member of the new national body rather than as part of a scientific organisation whose aims might be perceived as being somewhat narrower. Of course these options need not be mutually exclusive – the Group could still publish its more scientific material in BCRA publications, and, similarly, as part of BCRA the group could continue to offer training and present material at the national conference. Hence the effect on the Group's activities is likely to be minimal were either option to be pursued – the question is solely about where the Group best fits in the new structure.

From an administrative perspective, there are advantages to maintaining a close alliance with a larger body (the BCRA). The CSG is not a big organisation, and benefits from some of the services the BCRA provides (credit card handling facilities for example) that it would probably not be possible to provide as a standalone organisation. On the other hand, the minor crisis surrounding the CSG committee at the moment suggests we might be able to get more people involved if we were not a BCRA SIG – at present, if Wookey and Anthony were to follow Andy's lead and resign their membership of BCRA, the CSG would cease to be a BCRA SIG by default.

Another, more radical suggestion, is that the CSG should integrate even more closely with BCRA. If the majority of the material that is currently published in Compass Points could be found a home in either Speleology (a new BCRA publication – see David Gibson's description in this issue) or Cave and Karst Science, such material would probably reach a wider audience. There would then be little reason to continue publishing a separate dedicated surveying magazine. The CSG would then be relieved of most of its administrative burden and could concentrate on conducting its own experimental work and promoting the work of others. A counterargument is that surveying related material would then be split between a number of publications, which might ultimately be less convenient than having a single resource.

The editor wants to hear from you if you have any opinions on the topics raised above – otherwise whatever remains of the committee will do what they see fit. Given the current upheaval in the organisation of British caving, this is a good opportunity for us to decide where we want to take the Group next.

Snippets

Arthur Butcher Award

The Arthur Butcher award is presented annually by BCRA for, broadly speaking, “excellence in cave surveying.” The 2002 award was announced at the Hidden Earth conference, and went to the “Laki Underground team, particularly Chris Woods and Ed Waters.”

The judges commended the good combination of geographers doing detailed surface work, such as with DGPS transects, and cavers surveying underground. This produced clear, detailed cartography relating cave and surface features, and a good overview using satellite photographs. The judges also liked their analysis of lava tube magnetic anomalies and the techniques used to deal with them. Effective use of GPS and DGPS was also in evidence, as was good documentation of the methods used.

New BCRA Publication: Speleology

David Gibson

BCRA has ceased production of its "glossy" magazine, Caves & Caving, and replaced it with a new publication, called Speleology, which is intended to be more of a science-based than a news-based magazine.

BCRA has given several reasons for this change in direction. Some of you may be aware that the National Caving Association (NCA) and BCRA are currently discussing the "consolidation" of services into a single national body for UK caving. In support of this, BCRA has agreed to drop its "national body" functions - such as insurance and a glossy magazine - and to concentrate on cave science. But, having dropped the glossy news magazine, BCRA needs a publication to balance its academic journal Cave & Karst Science. This is where Speleology fits in; it has been suggested that if C&KS were considered to be Nature magazine, then Speleology could be New Scientist.

The editor, David Gibson, says he intends to pursue this suggestion, and hopes that Speleology will act as a forum for the Special Interest Groups to promote themselves to BCRA's wider readership. The intention is not to dilute the content of the SIG journals, nor to poach authors from them, but you may see the occasional SIG article reproduced in Speleology in an edited or updated form.

Speleology will, it is thought, be considerably cheaper to produce than was C&C. The production standard of Speleology is intended to match that of C&KS.

Those CSG members who are only Associate Members of BCRA will not receive the new magazine. However, rather than take out a full membership of BCRA (which is now £25) you might like to subscribe to Speleology magazine as a non-member of BCRA. We are told (December 2002) that the subscription, for three issues a year, is likely to be around £8.00, but check the BCRA website for the latest details.

One final point of interest is to do with the public liability insurance that BCRA currently provides for its members, including associate members. Under the "consolidation" plans currently being discussed, responsibility for this insurance will, at some stage, pass from BCRA to the new national body (name as yet undecided) and so those CSG members who joined BCRA as associate members specifically for the insurance may, in the future, have to join the new national body to receive this insurance. BCRA will, of course, keep you informed about the situation.

New Leica DISTO

The new generation of Leica DISTO laser distance measurers have recently become available. York Survey Supply Centre is currently offering the DISTO lite for £199 and the DISTO Classic for £299 (prices exclude VAT, delivery free within the UK). Both models claim to be accurate to ±3 mm over a range from 0.2 to 200 m and incorporate a spirit level and illuminated display. The extra features on the Classic model include a built in view finder, more built in functions and a storage facility for the last 15 readings plus 10 additional constants.

To order, contact:

York Survey Supply Centre,
Prospect House,
George Cayley Drive,
Clifton Moor,
York,
YO30 4XE

email: sales@yorksurvey.co.uk
Website: http://www.yorksurvey.com

UIS Geomorphology Symbols

Philipp Häuselmann

After having successfully completed the standardizing of the subterranean cave symbols, the UISIC Topography and mapping Group is currently working on another task: a standardization of the geomorphologic surface symbols used on karst terrains.

After inquiries on the symbols already in use and after collecting of various symbol lists, a set of symbols that seemed most appropriate was put together and presented as well as to the UIS as to the IGU. The feedback, however, was unsatisfactory, so we felt that a round table discussing the proposed symbols and the future directions would be most satisfactory.

The goal is therefore to discuss the proposed symbols, get an agreed, comprehensive symbol list, and have clear aims for the year to come. Everyone interested or working in geomorphological mapping of karst terrains is invited to attend. The round table discussion will be hosted by the Karst Conference at Bowling Green, KY, USA (http://karst.wku.edu/2003/)

The proposed list can be found at:
http://www.earthsci.unibe.ch/people/praezis/symbol1.html

Suggestions can be sent directly to me in my capacity as the chairman of the UISIC Topography and Mapping Group. The address is:

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Field Meet Report

The Autumn CSG field meet took place at Penwyllt, the headquarters of the South Wales Caving Club, over the weekend of 26th-27th October. Surveyors were a little thin on the ground – a weather forecast promising biblical flooding and a minor hurricane probably didn't help attendance. Nevertheless, the following hardy individuals turned up on Saturday morning to help with our experiments: Allan Richardson, Anthony Day, Vince Allkins, Jos Burgers, Graham Christian, Brian Clipstone, John Wilcock and Ian Alderman (the latter were also performing a dowsing experiment that day).

The two aims of the weekend were to try and test the accuracy of radiolocation equipment and to offer the opportunity for some practice surveying for those who felt they needed it. For both these purposes, we went to the large passages close to the top entrance of Ogof Ffynnon Ddu (OFD). Here, a theodolite survey has ascertained the positions of a number of underground points with a high degree of accuracy. The radiolocation beacon was successively placed on two of these whilst Graham, John and Ian dodged the sleet showers on the surface with the receiver coil. Meanwhile, everyone else got down to some surveying, inbetween nipping outside to help with the radiolocation effort so that everyone got to have a go. In order to make ourselves useful to the OFD resurvey project, we surveyed the positions of the walls in some of the large passages near the Top Entrance. This gave us all a chance to practice using the instruments and sketching the passage approximately to scale. We also got the chance to play with SWCC's digital clinometer, and were generally pretty impressed. I hope to include an article about the construction of this device in a future issue of Compass Points. To complete the afternoon's activity, Jos and Anthony performed a short (and soggy) surface survey from the surface locations obtained from radiolocation to a fixed point so we could try and get some idea of whether our radiolocation fixes were any good.

Unfortunately, when we processed the data in the evening, we found that our surface locations were approximately 22 m north and 13 m east of the underground positions. With this bias removed, the positions agreed within ~1.5m – so it seems clear that the "fixed" point we surveyed to wasn't as fixed as we would have liked. The CSG is obviously cursed – the last time we tried to conduct a similar experiment at SWCC, a similar string of cock-ups occurred (see Compass Points issue 24 for details). At the time of writing, we still haven't sorted out where the fixed point we thought we had connected the survey to really is.

There was little enthusiasm for sorting the problems out on Sunday morning as the weather was dire so everyone drifted off home. It was still a worthwhile meet, despite the elements. Thanks are due to Allan Richardson for organising it, and to SWCC for the use of their facilities.

Revised BCRA survey grades

The new BCRA booklet "Cave Surveying" (reviewed elsewhere in this issue) includes a revised version of the survey grades. The tables as printed in the booklet are reproduced below:

Grade 1	SKETCH OF LOW ACCURACY WHERE NO MEASUREMENTS HAVE BEEN MADE
(Grade 2)	May be used, if necessary, to describe a sketch that is intermediate in accuracy between Grade 1 & 3
Grade 3	ROUGH MAGNETIC SURVEY. HORIZONTAL & VERTICAL ANGLES MEASURED TO ±2.5º; DISTANCES MEASURED TO ±50 cm; STATION POSITION ERROR LESS THAN 50cm.
(Grade 4)	May be used, if necessary, to describe a survey that fails to attain all the requirements of Grade 5 but is more accurate than a Grade 3 survey.
Grade 5	**MAGNETIC SURVEY: HORIZONTAL and VERTICAL ANGLES MEASURED TO ±1º; DISTANCES SHOULD BE OBSERVED and RECORDED TO THE NEAREST CENTIMETRE and STATION POSITIONS IDENTIFIED TO LESS THAN 10cm.**
Grade 6	MAGNETIC SURVEY THAT IS MORE ACCURATE THAN GRADE 5, (see note 5).
Grade X	SURVEY THAT IS BASED PRIMARILY ON THE USE OF A THEODOLITE OR TOTAL STATION INSTEAD OF A COMPASS, (see notes 6 and 10 below).

NOTES:

1 The above table is a summary and is intended only as an aide memoire; the definitions of the survey grades given above must be read in conjunction with these notes.

2 In all cases it is necessary to follow the spirit of the definition and not just the letter.

3 To attain Grade 3 it is necessary to use a clinometer in passages having appreciable slope.

4 To attain Grade 5 it is essential for instruments to be properly calibrated, and all measurements must be taken from a point within a 10cm diameter sphere centred on the survey station.

5 A Grade 6 survey requires the compass to be used at the limit of possible accuracy, i.e. accurate to ±0.5º; clinometer readings must be to the same accuracy. Station position error must be less than ±2.5 cm, which will require the use of tripods at all stations or other fixed station markers ('roofhooks').

6 A Grade X survey must include on the drawing notes descriptions of the instruments and techniques used, together with an estimate of the probable accuracy of the survey compared with Grade 3, 5 or 6 surveys.

7 Grades 2 and 4 are for use only when, at some stage of the survey, physical conditions have prevented the survey from attaining all the requirements for the next higher grade and it is not practical to re-survey.

8 Caving organisations etc., are encouraged to reproduce Table 1 and Table 2 in their own publications; permission is not required from BCRA to do so, **but the tables must not be reprinted without these notes.**

9 Grade X is only **potentially** more accurate than Grade 6. It should never be forgotten that the theodolite/Total Station is a complex precision instrument that requires considerable training and regular practice if serious errors are not to be made through its use!

10 In drawing up, the survey co-ordinates **must** be calculated and not hand drawn with scale rule and protractor to obtain Grade 5.

Table 1: BCRA gradings for a cave line survey

Class A	All passage details based on memory.
Class B	Passage details estimated and recorded in the cave.
Class C	Measurements of detail made at survey stations only.
Class D	Measurements of detail made at survey stations and wherever else needed to show significant changes in passage dimensions.

NOTES:

1 The accuracy of the detail should be similar to the accuracy of the line.

2 Normally only one of the following combinations should be used:- 1A, 3B or 3C, 5C or 5D, 6D, XA, XB, XC or XD.

Table 2: BCRA gradings for recording cave passage detail.

The line survey grades (Table 1) differ from the previous version as published in Ellis (1988) and Ellis (1976). These earlier versions of the grades were defined in terms of the accuracy of measurements (e.g. to claim Grade 5 under the old definition, all angular measurements were required to be *accurate* to 1°.) The authors of the new booklet felt that measuring the accuracy of individual measurements was a very difficult task, and one that was rarely performed in practice, with the result that it is impossible to prove that many surveys for which Grade 5 has been claimed actually met the requirements of the grade as defined at the time. They therefore felt that a grade definition based on the *precision* of measurements was more appropriate. A precision of 1° was chosen for angular measurements for Grade 5 as this is a realistic precision that can be obtained using the instruments recommended for this grade.

It has been pointed out on the cave surveying email list that the tables are now inconsistent in that they still use the term "accuracy" in defining other grades and in the accompanying notes. As one of the authors, I can only apologise for this oversight and state that it was our intention to base the grading system entirely on a definition of precision.

The tables are now online at http://www.bcra.org.uk/surveying, and it is likely that the wording of this version will be adjusted to resolve the ambiguity outlined above. The online version of the grades will therefore be the definitive version. If anyone spots any more cock-ups, or has any other comments, please address them to the editor.

Compass Misreadings and Maglites

Jos Burgers

The topic of compass lighting without introducing any magnetic effects has cropped up in Compass Points many times in the past. In this article, Jos Burgers discusses the causes of these magnetic effects and presents another solution to the compass lighting problem.

As everybody knows, the compass points north due to the influence of the earth's magnetic field, but can also be influenced by other elements e.g. iron. When the compass does not point north due to outside influences, this is named a misreading. In order to prevent such misreadings, we must first understand what causes them.

I did surveying in the military. I am not proud of that, it is just so. In the service I had a job as a field surveyor, in the course of which I learned a number of (for me) interesting things. For instance the influence of "wheeled vehicles" (lots of iron) and "caterpillar vehicles" (much more iron) on the compass needle. I also learned that you should not get too close to agricultural electric wire because the electric current has a magnetic effect too. I recalled an experiment from my science class in which a loose compass needle was placed on a vertical pivot beneath a copper wire. When a current was passed through the wire, the compass needle would turn to point in the length direction of the wire, whereas without the current it would point North. These experiences apply to cave surveying too: prior to an expedition to Laos, in which I participated, we undertook a practice survey in Trou Haquine and observed significant compass misreading due to the iron gate.

Caves are dark, so in order to take compass measurements you need extra light. For compasses that do not have internal lights, the most convenient means of providing extra light is with a little torch, such as a maglite® held in your hand above the compass window. If your lamp is too close to the compass, it will give a misreading. This is easy to prove on the surface - you can see the needle turn as you move your light closer. However, when messing around in the dark whilst surveying, you tend to focus on lighting the compass adequately rather than keeping the light sufficient distance from the compass.

There are many gadgets available to adapt the maglite for specialised usage: rings to hang them on your belt; brackets for your bike; and also a piece to guide the beam trough a fibre-optic thread (fibre-optic adapter – see Figure 1). It works. Even though you are supposedly only using part of the beam because it doesn't bundle the light, you have enough light to read the compass. For the Laos expedition, I mounted it on my helmet and with a simple construction bent the fibre so that it shone exactly in front of my right eye.

My fellow expedition members were less enthusiastic. They envisaged that wire disappearing into my eye and didn't care to think about the consequences so far away home somewhere in the jungle. Another not so practical thing is that you don't want to take with you a lot of little flashlamps, so you start using this lamp for other things too.

During our expedition preparations someone conducted an experiment at the kitchen table to determine the distance you need to hold your lamp from the compass. He didn't use a maglite but his Oldham headset attached with a wire on his helmet. To our astonishment there was no recordable misreading! We concluded that the current was insufficient to give a magnetic disturbance. So what was strong enough? The metal parts of the Oldham headset? No. The metal parts of the maglite? We took the cells out of the maglite and held the flashlight on the compass. Nothing! No movement of the compass needle. The needle pointed undisturbed North. With the batteries you could approach the compass up to 4 cm without disturbance. Hmm, what now?

The Laos expedition is over, and since then another expedition (a Belgian expedition to Socotra, an island off Yemen) has finished too. In one of their first e-mails they were enthusiastic about the LED headlamps, in particular the Petzl Tikka. By return e-mail Ed Stevenhage reported that this headlamp gives a clear misreading for compass readings. He performed a test using a wooden disc he could turn. I instantly thought about the batteries directly behind the little lamp on your forehead.

LEDs are useful because they don't use much energy. I discussed it with some people and Casper from the kayakclub worked out my thoughts. I gave him a maglite, and came up with the following: If you just used one AA cell in your maglite rather than the usual two and bridge the distance between the lamp and the cell with an aluminium tube, then the distance probably be big enough to prevent the magnetic disturbance and consequent misreading. A single LED may be used instead of a conventional bulb to save on energy since you don't need that much light.

It has been suggested that non-alkaline cells may give less disturbance, but this is not really my field. Who knows, there may be another solution. However, using a LED, a resistor and a cell Casper made the following little torch (Figure 2) and it works. There is no recordable magnetic disturbance. What more could you want?

This article has been adapted from a Dutch version that appeared in "Pierk", the Dutch national caving magazine, in 2002.

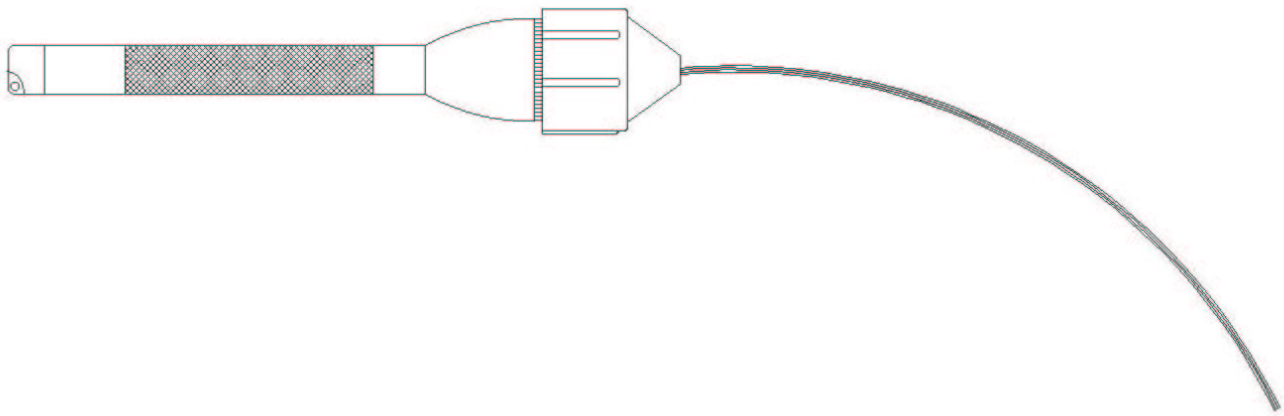

Figure 1: Fibre optic adaptor for maglite

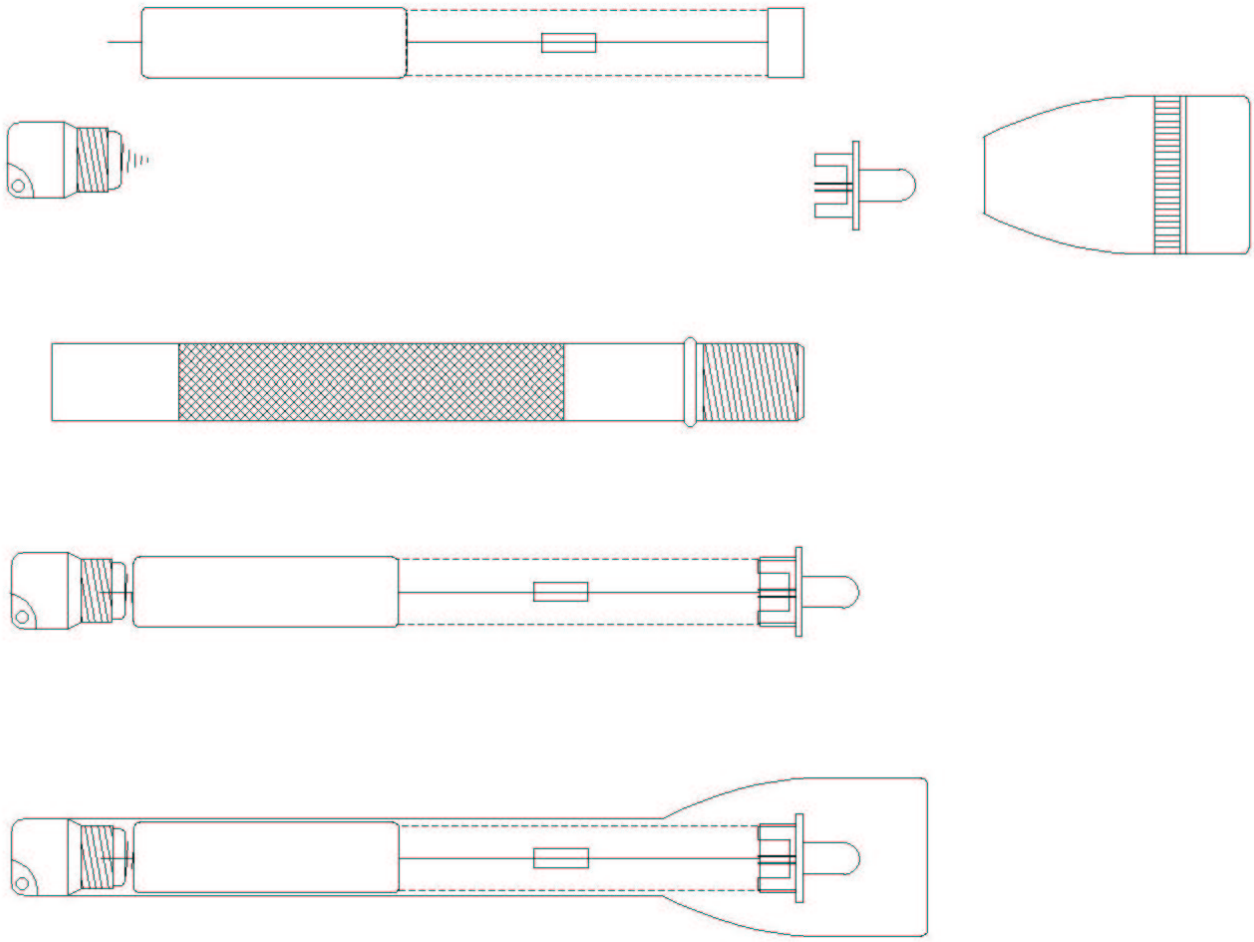

Figure 2: Maglite adapted to run a single LED from one AA cell without any magnetic effect on the compass.

Book Review: Cave Surveying

Juan Corrin

Cave Surveying *– a guide to the equipment, techniques and methodology of the BCRA system, by Anthony J Day (assisted by John Eyre, Paul Deakin and David Judson). Published by BCRA as no. 11 in the BCRA Cave Studies Series. Series Editor David Judson. ISBN 0 900265 25 6.*

40 A5 black and white pages including a foreword by Dave Brook, 4 tables and 14 figures, plus full colour cover.

Price £3.50. Available from the usual caving suppliers and BCRA (see www.bcra.org.uk/pub/studies.html for details of how to order).

The booklet sets out to provide a starting point for newcomers to cave surveying and to serve as an *aide memoire* to experienced surveyors. The author acknowledges the influence of Brian Ellis's *An Introduction to Cave Surveying*, but this handbook has been written from scratch. In recent years on the Matienzo caving expeditions to northern Spain, newcomers and experienced surveyors annually map 4 or 5km of new passage – more than 200 km has been surveyed in the area over thirty years. So should *Cave Surveying* become obligatory reading for Matienzo cavers?

There are four chapters taking the reader through the cave surveying process: Introduction and methodology; Equipment, data collection and recording; Presentation and publication and Project Management. The centre sheet contains useful information about cave surveying software, internet resources and current prices for survey equipment. These pages can be removed and replaced with an update from the BCRA website or from BCRA sales – an excellent idea. They would be even more useful if further categories of equipment had been listed, e.g. sources of waterproof survey booklets and printers / plotters for larger surveys.

Chapter 1 introduces the basic method from setting up stations through to final survey production. The BCRA grades are presented as a measure of accuracy.

Chapter 2 goes into the detail of equipment, data collection and recording. Silva and Suunto compasses and clinometers are listed with hints for lighting the cards and warning about magnetic effects of some lighting systems. Distance measuring equipment includes a fibreglass reinforced tape and the more modern electronic measuring devices such as the Leica Disto Classic. Recording devices could include PDAs but various types of ruggedised paper are recommended, with a pencil, as the most reliable recording medium.

After highlighting the fact that pre-printed recording sheets are the best option it was rather a let down that suppliers of such paper were not listed. Other survey equipment discussed includes GPS for positioning entrances. Ways of marking underground stations without unduly disfiguring the cave are also mentioned.

Nearly two pages is taken up with tape, compass and clinometer calibration – a necessity if a grade 5 is to be claimed. The tasks required to carry out a survey are listed and roles allocated between the two or three people on the team. The pros and cons of the two basic surveying methods (forward and leap-frog) are outlined but the one recommended is the forward method with back checks for all legs. This of course adds considerably to surveying time and is unlikely to be norm on expeditions in smaller, wetter passages.

Sensible procedures for reading the instruments and writing down the data are followed by a section on what passage detail to record. It is impossible to guess the final scale of a published drawing if the cave is being explored and surveyed and "the end" has not been reached. So the suggestion that floor details should be recorded in the cave if the scale is 1:500 or more becomes meaningless if the passage is 10m wide and is drawn at 1:1000 where 1cm on the drawing is more than enough to incorporate floor detail. If the final drawing is produced from layers on computer it becomes a trivial matter to publish the survey at different scales with the floor detail layer not shown where it becomes indistinct. It should be general practice to collect the passage detail (floor, roof, walls) no matter what the expected scale of the survey. It might even be that parts of the cave survey are eventually required at a more detailed scale where the nature of the deposits is required.
The comprehensive field sketch on page 24 would have been more useful with the accompanying data collection sheet or at least some sort of scale indication, e.g. grid-lined paper.

The chapter concludes with the importance of accurately fixing the entrance(s) and some useful hints and tips.

Chapter 3 deals with producing the end product: determining the station positions, producing the centre line and adding passage details and accompanying sections and text. Equal emphasis appears to be given to hand drawing and computer production of the final survey. The advantages of computer production seem to far outweigh the disadvantages and I would have preferred to see a more detailed overview of a couple of computer packages, e.g. Survex and Compass, and how these aid the survey draughtsman. However, all the information and procedures given in this section will aid the novice and experienced surveyor alike if the computer fails. The production and reproduction costs of the final survey becomes larger as the size of the final sheet(s) increases: it would be useful to have (in the centrefold) some indication of suitable printers / plotters for A1 or A0 output. There is no mention of publishing on the Internet or CD / DVD. Computer-produced layered surveys are ready to export as gif files at various details and scales.

The old BCRA survey symbols have now been abandoned in favour of the UIS (1997) symbols. A double page has the most commonly used symbols both in plan and elevation form.

Chapter 4 discusses project management, and gives planning hints so when the cave starts to go in all directions, the survey with multiple teams doesn't get out of hand. The booklet is rounded off with references and further reading.

The end product from cave surveying is a complete survey, either hand-drawn, printed, or on a web site. It's a pity then, that the authors did not centre the comprehensive "how to do it" instructions around example surveys. In fact, there are no surveys in the booklet! Any other instruction manual would have many examples, e.g. photos in a "How to Take Photos" booklet. The tantalising glimpses of the Lancaster Hole survey on the cover are a poor example as the passage outlines touch in places and colour is used but not mentioned in the text. Even one real (or possible made up) example to dissect and explore would have been useful.

I cannot agree with the premise that the booklet is a starting point for cave surveyors. Surveying cannot be taught through a book. Newcomers will be much better off starting with experienced surveyors and then using the material to consolidate and extend their understanding of surveying. Combined with some real example surveys, the booklet then becomes good background reading both to assist the newcomer and keep the experienced surveyor on their toes. At £3.50 the booklet is excellent value.

Cave Surveying will certainly be in the Matienzo library and the booklet should be compulsory reading for all apprentice surveyors alongside practical instruction. Every caver producing surveys or assisting in survey production should buy a copy.

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